

2004 Commissioning Run

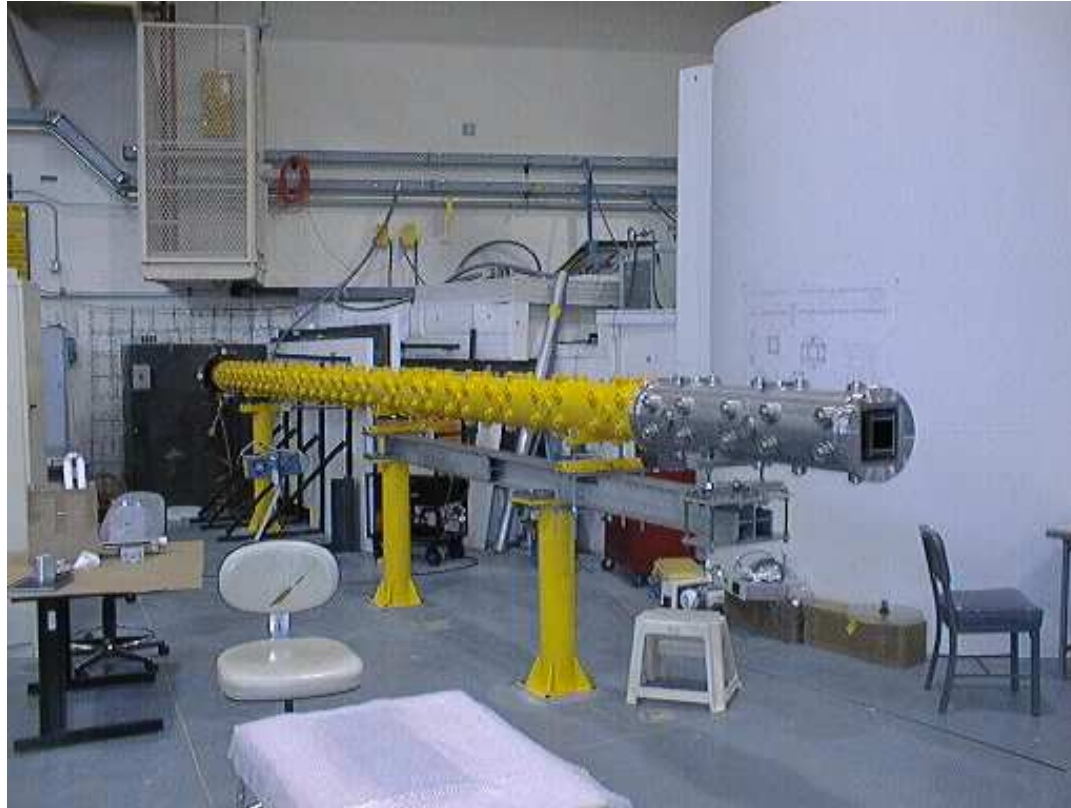
- Commissioned NPDGamma Experiment and Beam Line February–April, 2004
- All components except LH_2 target fully tested
- Only minor problems identified
- All commissioning goals from plan given to DOE met

Commissioning Goals

- Neutron guide system
- Neutron beam chopper
- Magnetic guide field system
- ^3He beam monitors
- ^3He polarizer
- RF spin flipper
- CsI detector array
- Detector electronics
- Data acquisition system
- Detector motion system

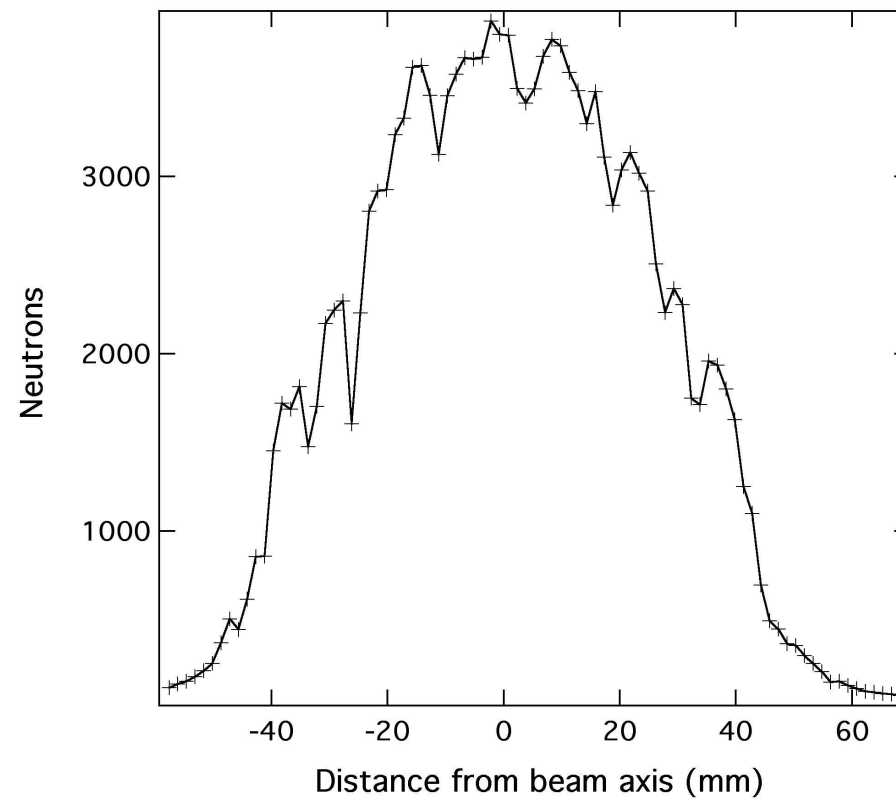
Neutron Guide System

LANL



- $m = 3$ supermirror guide, $9.5 \times 9.5 \text{ cm}^2$, 21 m long

Commissioning of Neutron Guide System



- Performance meets specifications
- No improvements needed

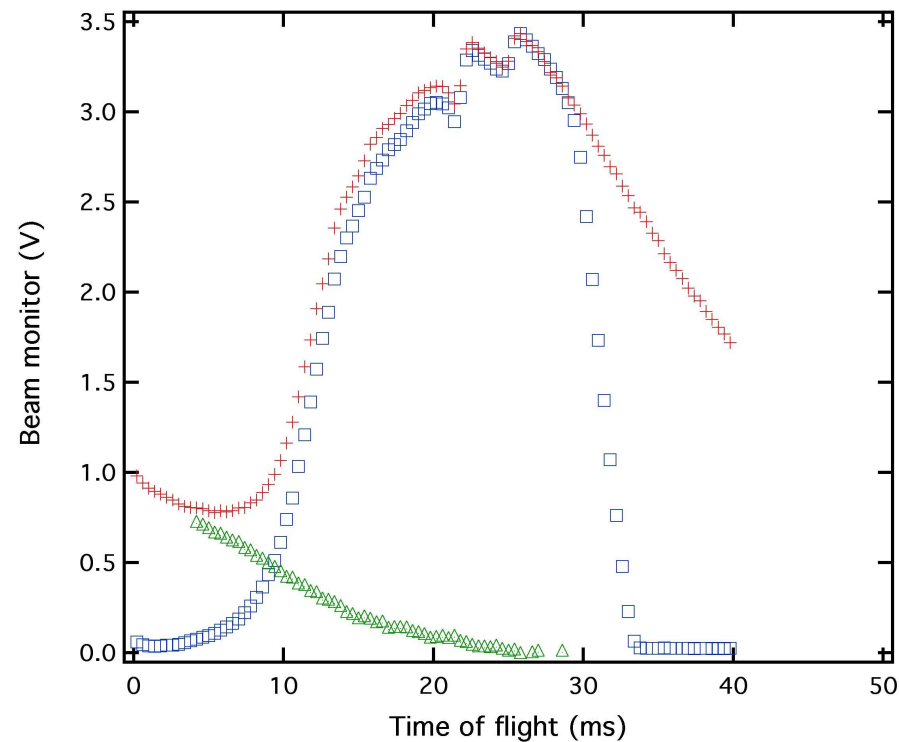
Neutron Beam Chopper

UNH, IU, LANL



- Two independent, redundant choppers
- 1 m diameter Gd_2O_3 coated aluminum blades

Commissioning of Neutron Beam Chopper



- Chopper performed as expected
- Improved electronics under construction to eliminate noise pickup

Magnetic Guide Field System

LBL, JLab, LANL



- Four coil race-track design, $B = 10$ G
- Gradient specification of < 1 mG/cm

Commissioning of Magnetic Guide Field System

- dB_y/dz within specification
- dB_x/dz and dB_z/dz less than 3 mG/cm
- Improvements planned: better measurements, shim coils

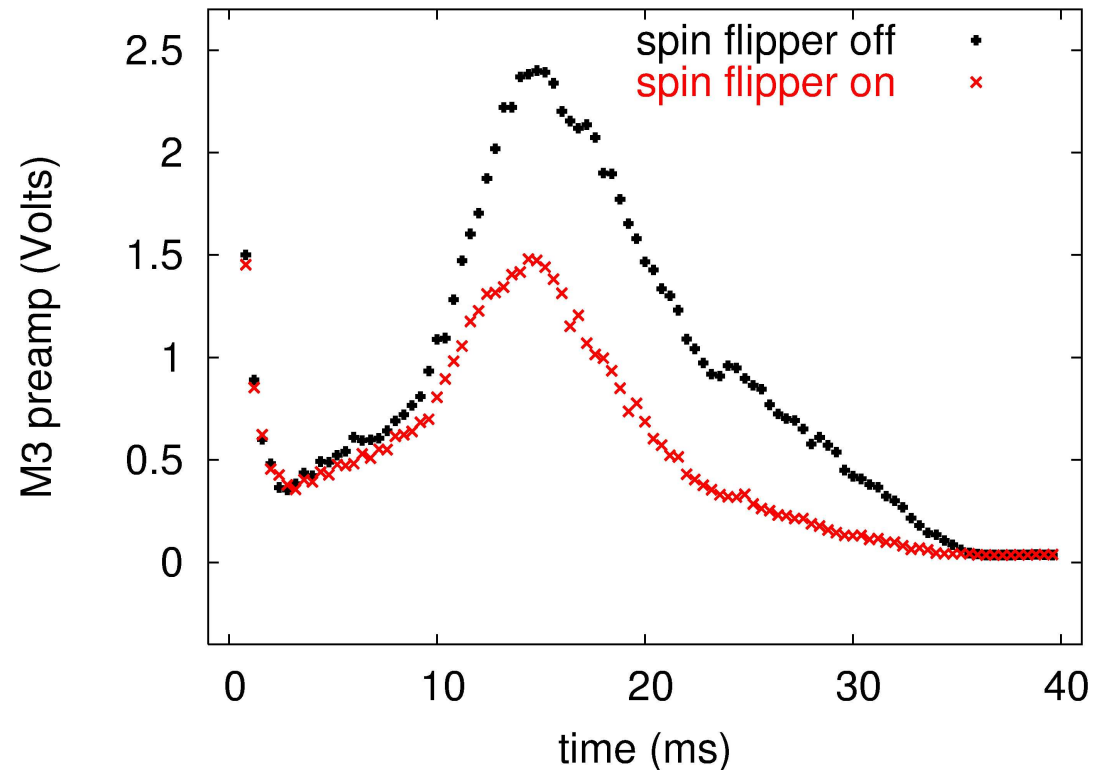
^3He Beam Monitors

Manitoba, TRIUMF, LANL



- ^3He ion chambers
- Measure neutron flux, polarization, spin flip efficiency

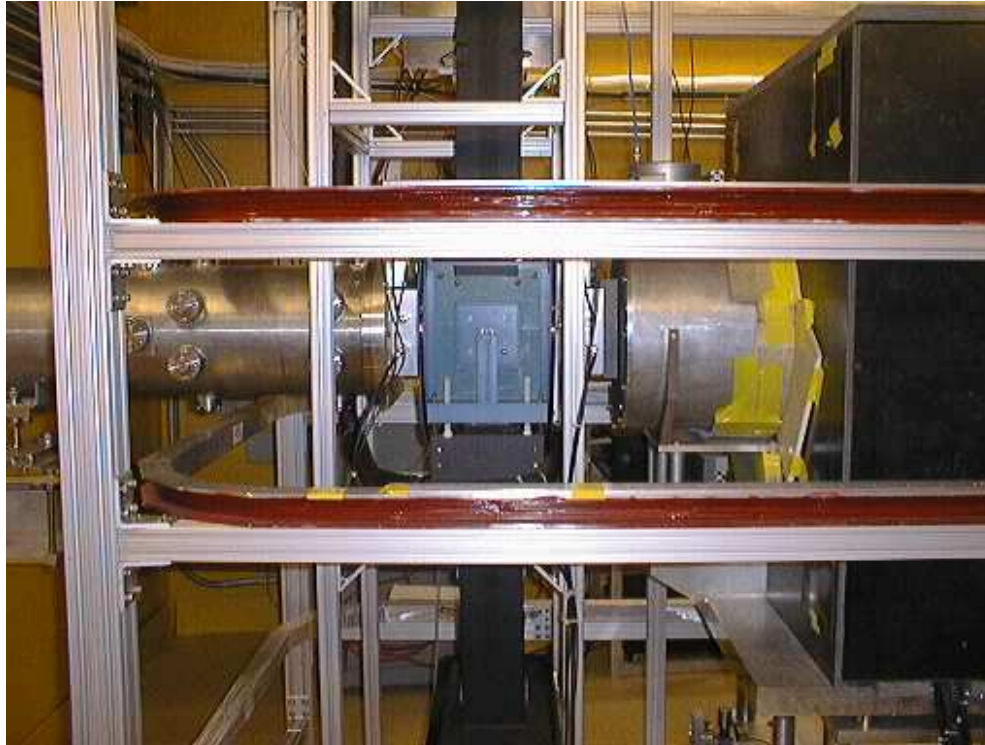
Commissioning of ^3He Beam Monitors



- Performance meets specifications
- More preamps under construction

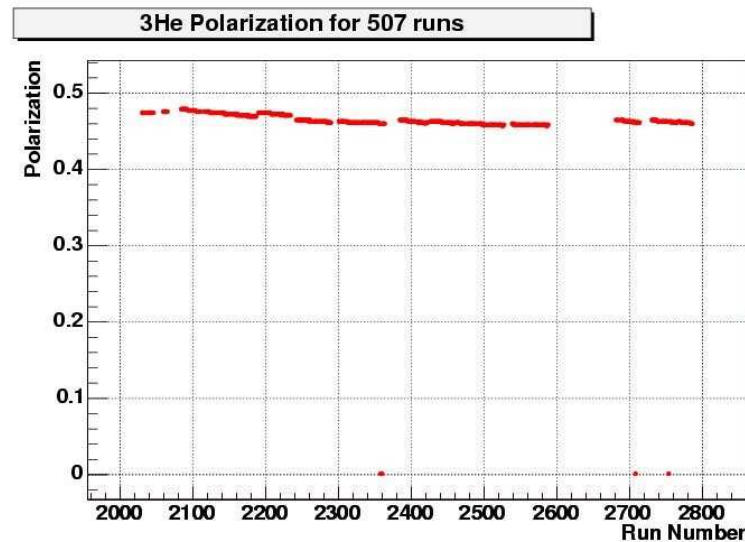
^3He Polarizer

Michigan, NIST, Hamilton, Dayton, UNH, LANL



- 12.6 cm diameter, 5.7 bar·cm ^3He cell
- 2×30 W laser power

Commissioning of ^3He Polarizer



- Polarizer very stable — $46 \pm 2\%$ average
- Work to improve P
- Fix adiabatic fast passage system

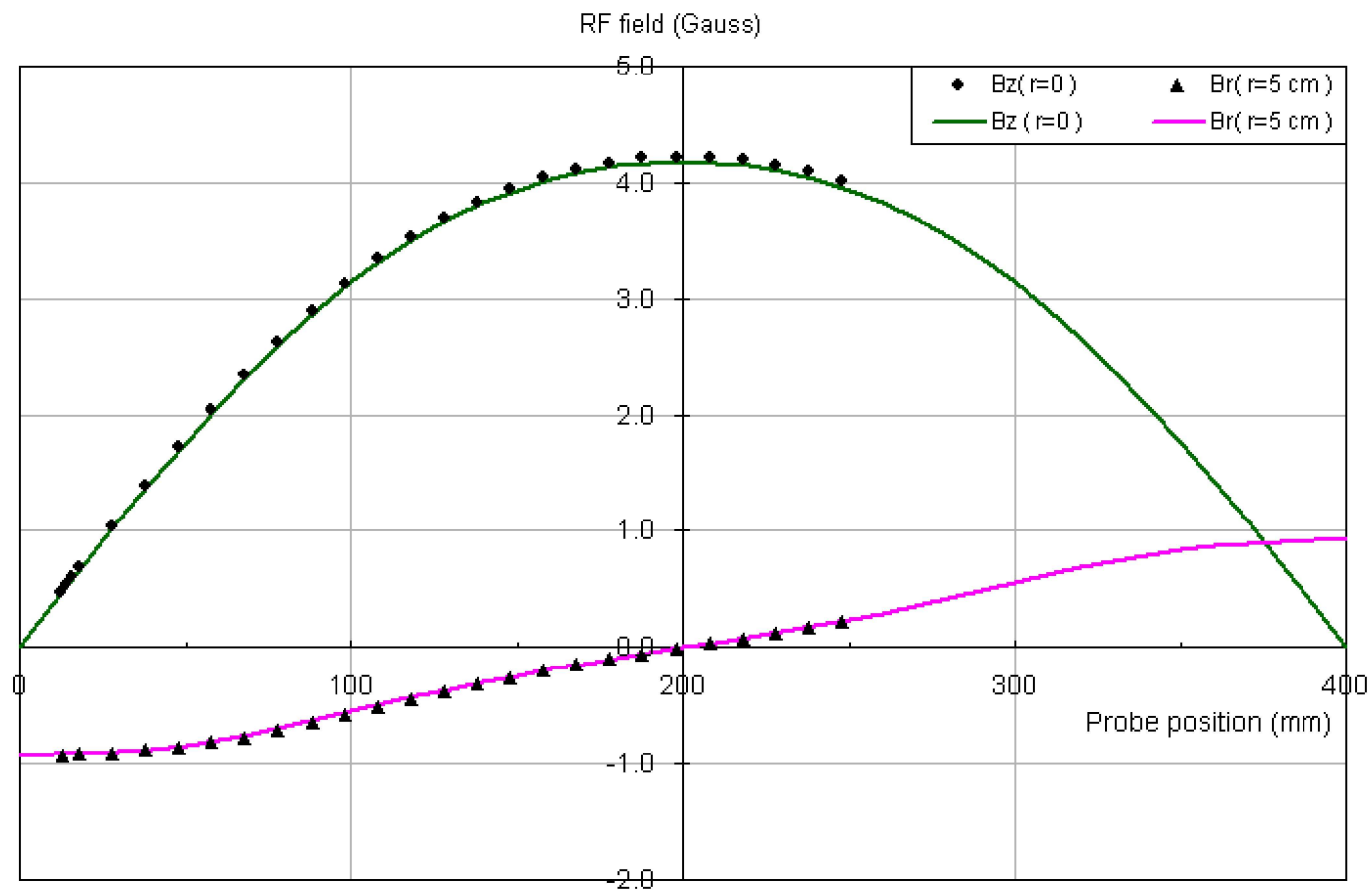
RF Spin Flipper

LANL



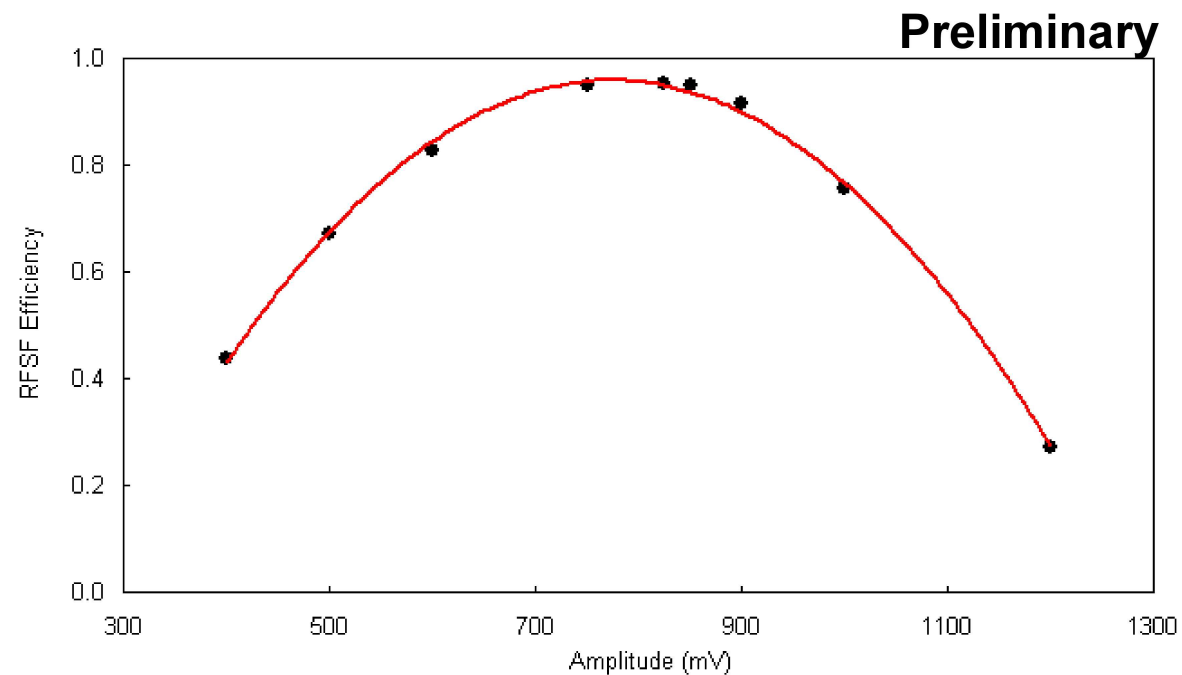
- 30 kHz axial magnetic field
- Rotation angle $\theta = \gamma B_{\text{rf}} \Delta t$, so need B_{rf} proportional to $1/t$

RF Spin Flipper Field Map



- Agreement with calculation $\sim 1\%$

Commissioning of RF Spin Flipper



- Spin flipper performed well
- Preliminary spin flip efficiency 95%
- More stable $1/t$ ramp generator needed

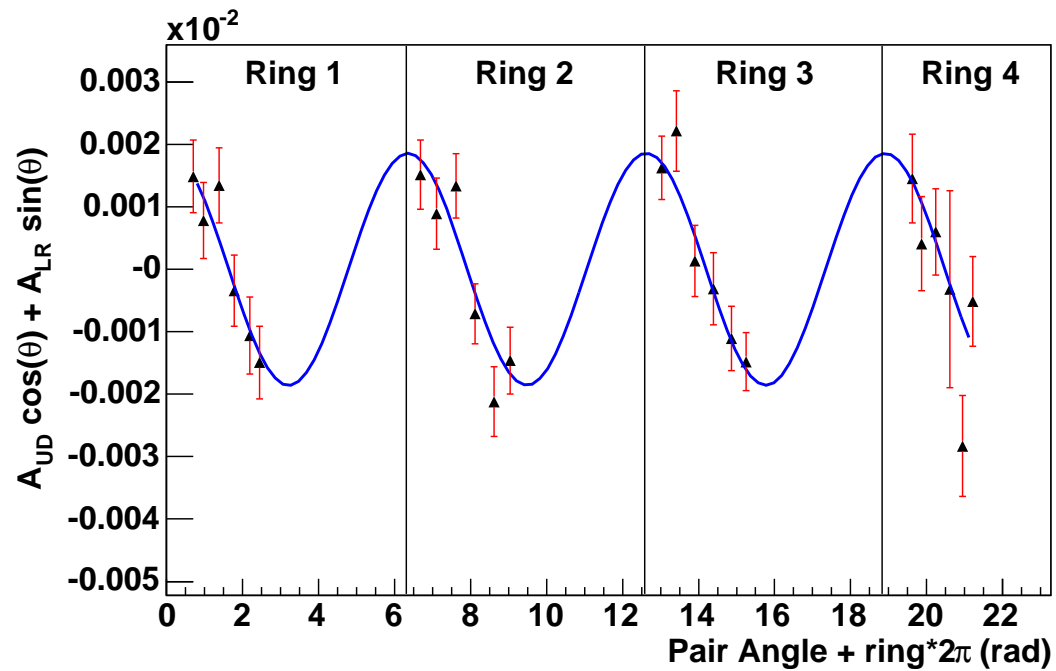
CsI Detector Array

IU, LANL, KEK



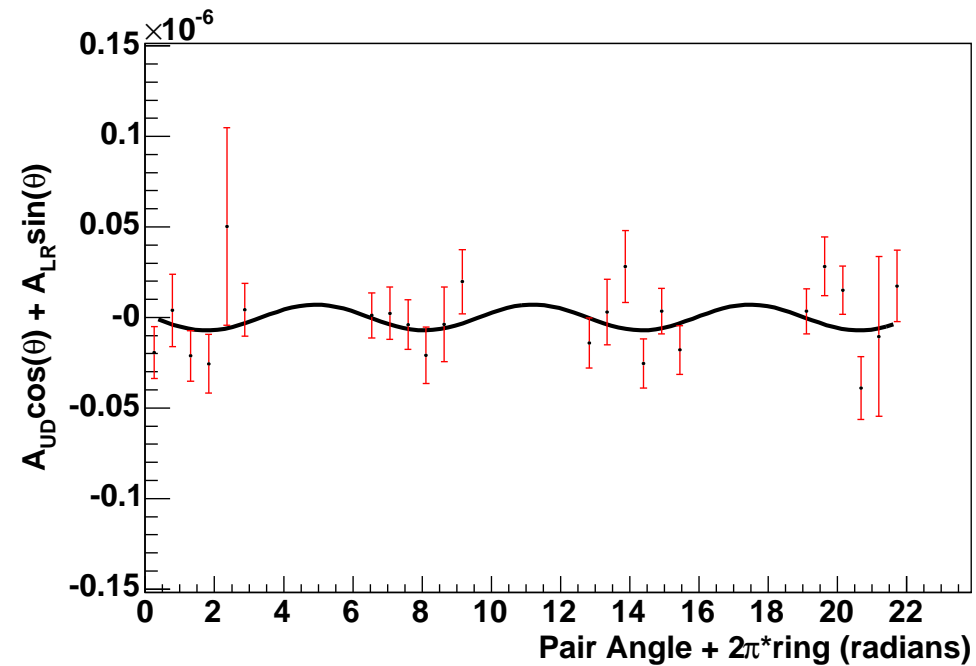
- 48 Element CsI detector array
- Each detector is $15 \times 15 \times 15 \text{ cm}^3$
- Scintillation light detected by vacuum photo diodes

Commissioning of CsI Detector Array



- Parity-violating and parity-conserving asymmetries in Cl
- $A_{pv} = 19 \pm 2 \times 10^{-6}$
- $A_{pc} = 0.6 \pm 2 \times 10^{-6}$

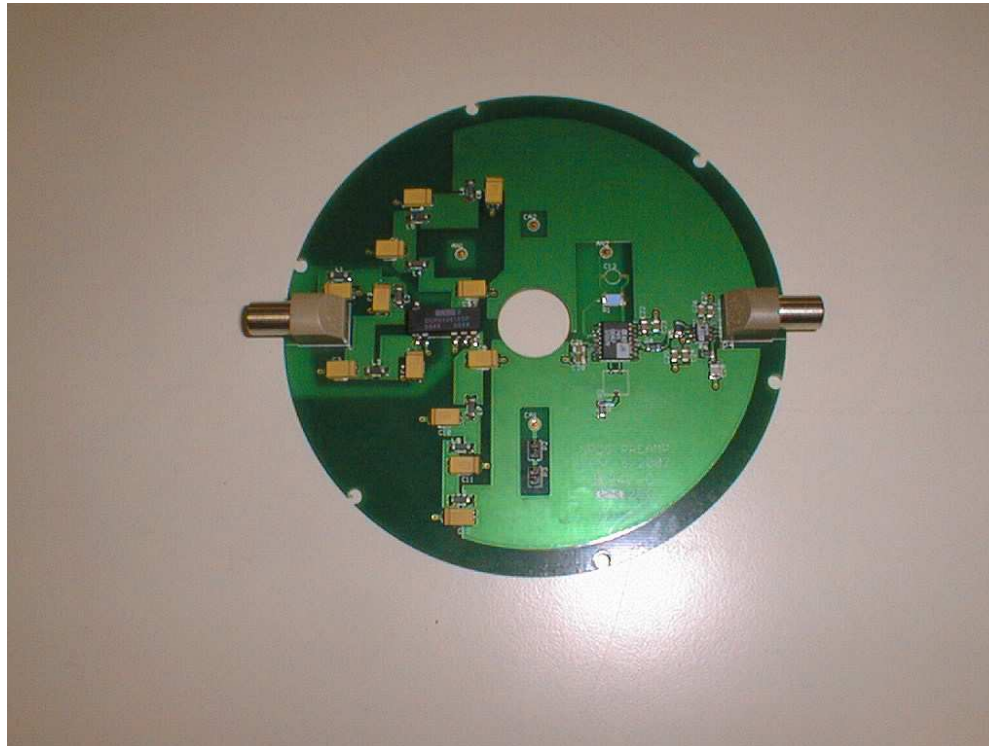
Commissioning of CsI Detector Array



- Beam-off asymmetries — pickup from spin flipper
- $A_{pV} = 1.5 \pm 4.5 \times 10^{-9}$
- $A_{pC} = -7 \pm 5 \times 10^{-9}$

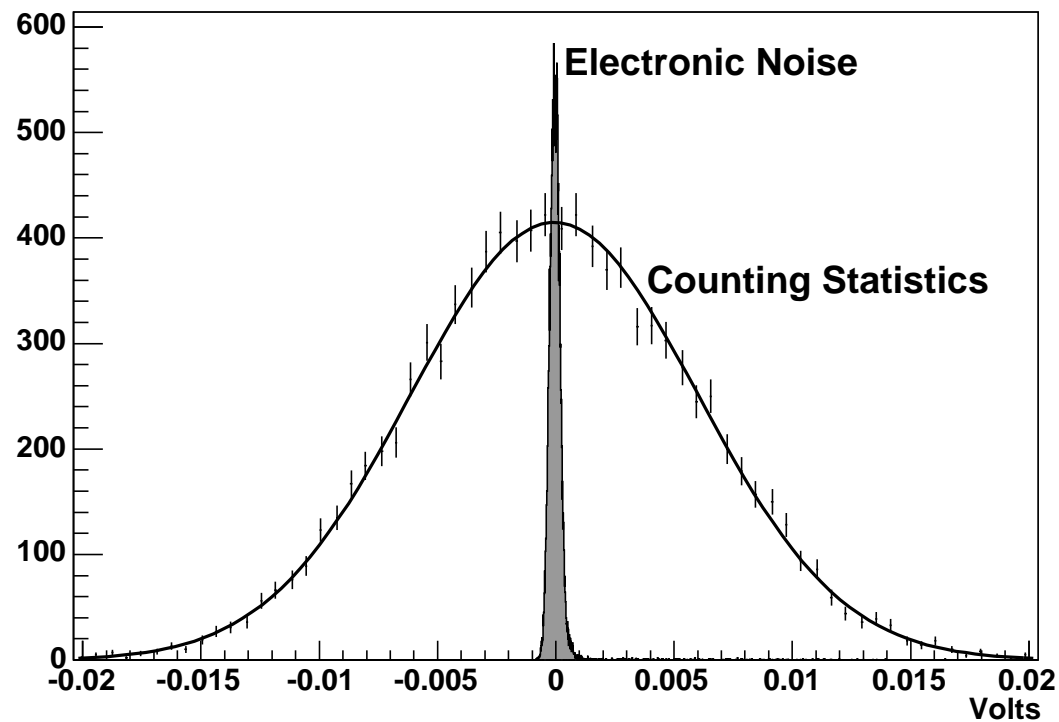
Detector Electronics

LANL, TRIUMF



- Current-mode, solid-state gain components
- Noise must be less than counting statistics

Commissioning of Detector Electronics



- Detector electronics perform well
- A few preamps need cleaning/repair for lower noise

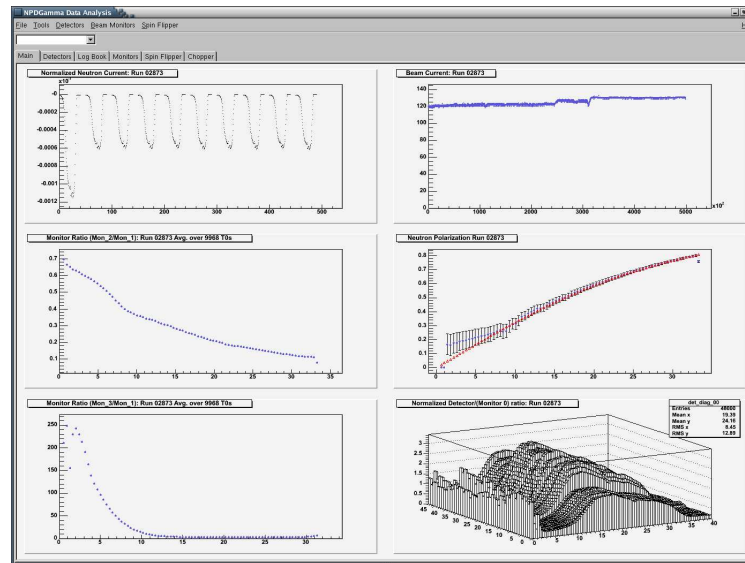
Data Acquisition System

LANL



- Three VME crates, 96 ADC Channels
- Data transferred via Ethernet
- 3 TB RAID storage

Commissioning of Data Acquisition System



- DAQ worked — 1 TB of data collected
- Some missing beam pulses (10^{-4}) — update software
- ADC sampling jitter — replace gate generators
- Online analysis continues to evolve

Detector Motion System

Manitoba, TRIUMF



- Remote controlled motion ± 10 mm in x and y
- Required to establish detector axes

Commissioning of Detector Motion System

- Some further software development required
- Limit checks for LH₂ target needed

Detector Pedestals

- Dominated by activation, time-dependent component
- Typically 7% of real signal from target
- Dilutes asymmetry measurements
- Complicates polarization measurements
- Indicates possible activation danger for detectors
- Improved shielding needed: more Li

Asymmetries from Construction/Shielding Materials

Effect on LH₂ Target Measurement

	PV (10^{-8})	PC (10^{-8})
Al	0.0 ± 3.0	2.0 ± 3.0
B	0.9 ± 1.6	-3.2 ± 2.4
Cu	2.4 ± 5.0	0.6 ± 5.0
In	-1.3 ± 0.9	-1.8 ± 1.3

Summary

- Commissioning run very successful
Better than many expected
- Heavy participation by collaboration
25 researchers from 11 outside institutions
- Learned about scheduling, interaction of subgroups
Important for future planning
- All components except LH₂ target fully tested
All goals met
- Only minor problems identified